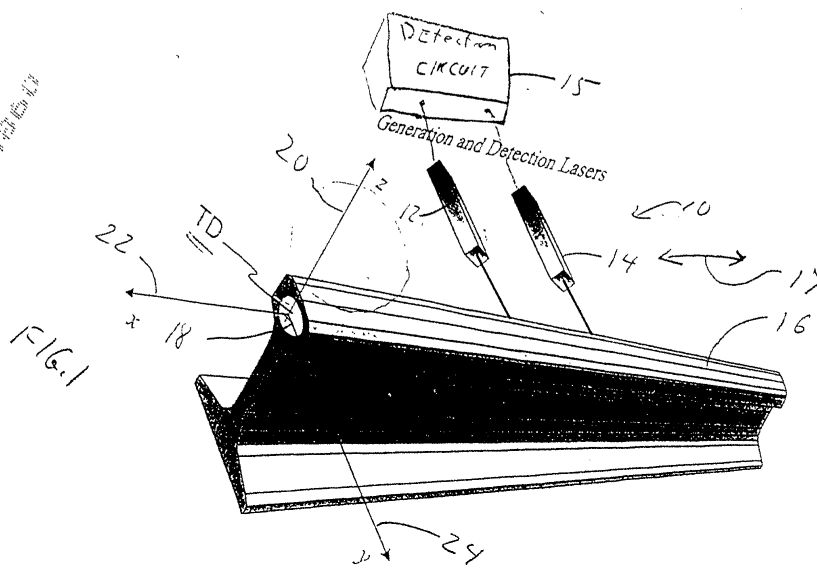


FIG. 1



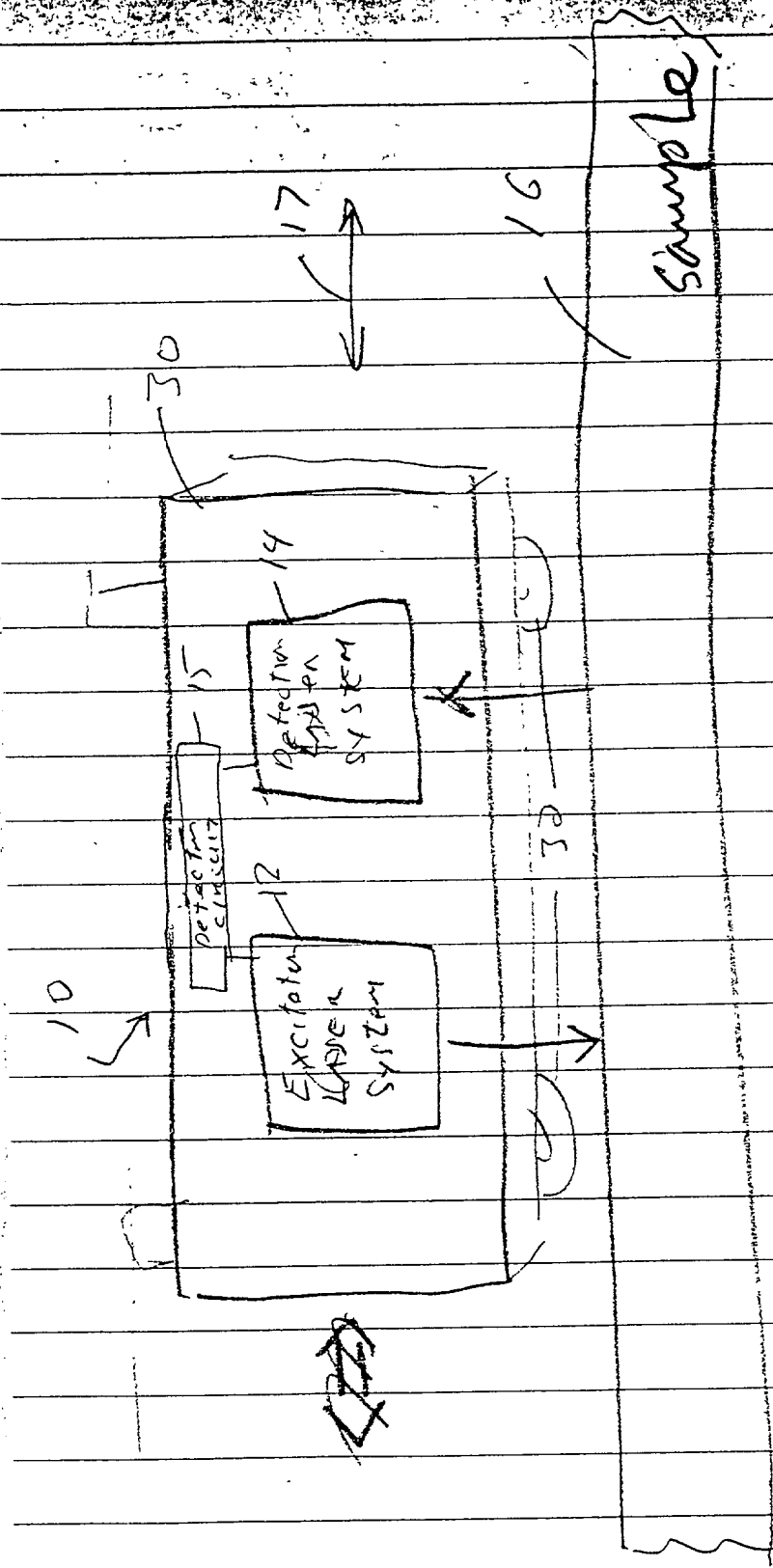


FIG. 2

The diagram illustrates a laser interferometer system for detecting defects in a rail. A horizontal bar represents the rail, with a section on the left labeled "(1) Defect-free zone". Above the rail, "Ultrasonic Beam Paths" are shown as dashed lines with arrows, labeled with handwritten numbers 44, 43, and 70. A label "TD" is also present near these paths. The rail itself is labeled "Rail Head" on the right. Below the rail, an "Excitation Laser (Nd:YAG)" is represented by a vertical rectangle labeled 12. A horizontal arrow labeled 40 points from the laser towards the rail. A point "A" is marked on the rail's surface directly below the laser. A horizontal distance "x" is indicated between point "A" and another point "A'". Below point "A'", a "Detection Laser Interferometer (Photo-EMF)" is shown as a rectangular block labeled 14. A horizontal arrow labeled 60 points from point "A'" towards the interferometer. A label "CIRCUIT" is written above the interferometer block. A double-headed horizontal arrow labeled 17 is located to the right of the interferometer. Various other handwritten numbers (13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100) are scattered throughout the diagram, likely corresponding to parts of a larger figure set.

The diagram illustrates the LASSO system for rail flaw detection. A horizontal bar represents the rail, with a section on the left labeled "(2) Flawed zone". Above the rail, "Ultrasonic Beam Paths" are shown as multiple lines with arrows, reflecting off the rail surface and a flaw. A "TD" (Time Delay) is indicated between the rail and the ultrasonic paths. The right end of the rail is labeled "Rail Head". Below the rail, an "Excitation Laser (Nd:YAG)" is shown as a vertical rectangle labeled "66". A horizontal line with arrows labeled "44" connects the laser to a "Detection Laser Interferometer (Photo-EMF)" system, which is a rectangular box labeled "62". A double-headed arrow labeled "17" indicates the distance between the laser and the system. The text "LASSO" and "Technologies Inc." are written in the bottom right corner.

Figure 2: Proposed photoacoustic rail flaw detection scheme and the experimental setup used for conducting the proof-of-concept tests. Both excitation and detection lasers illuminate the same side of a rail sample containing a transverse defect.

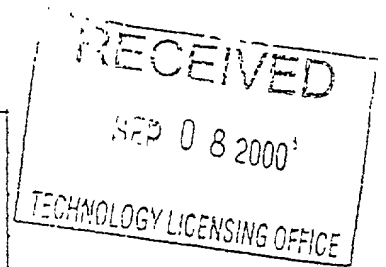
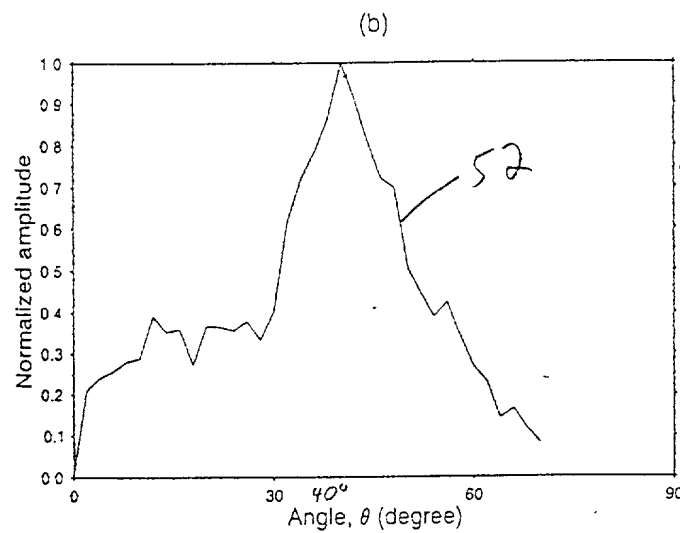
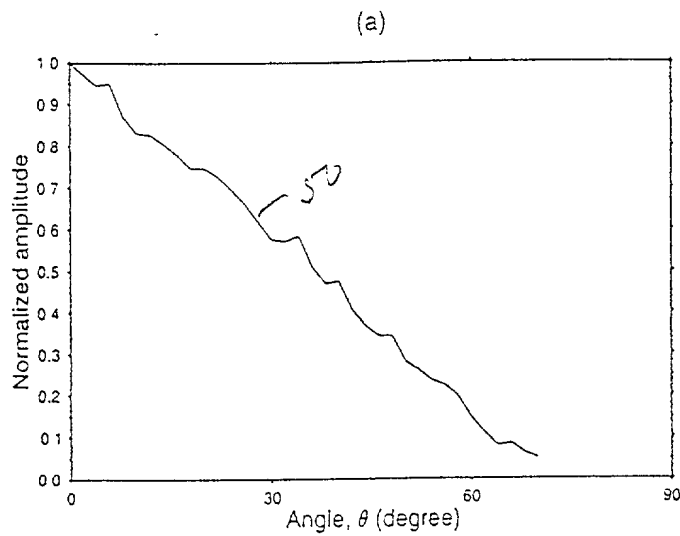


Figure 4: The measured out-of-plane displacements as a function of propagating angle θ for the aluminum specimen: (a) longitudinal out-of-plane displacements (U_y^L); (b) shear out-of-plane displacements (U_y^T).

105070-578866

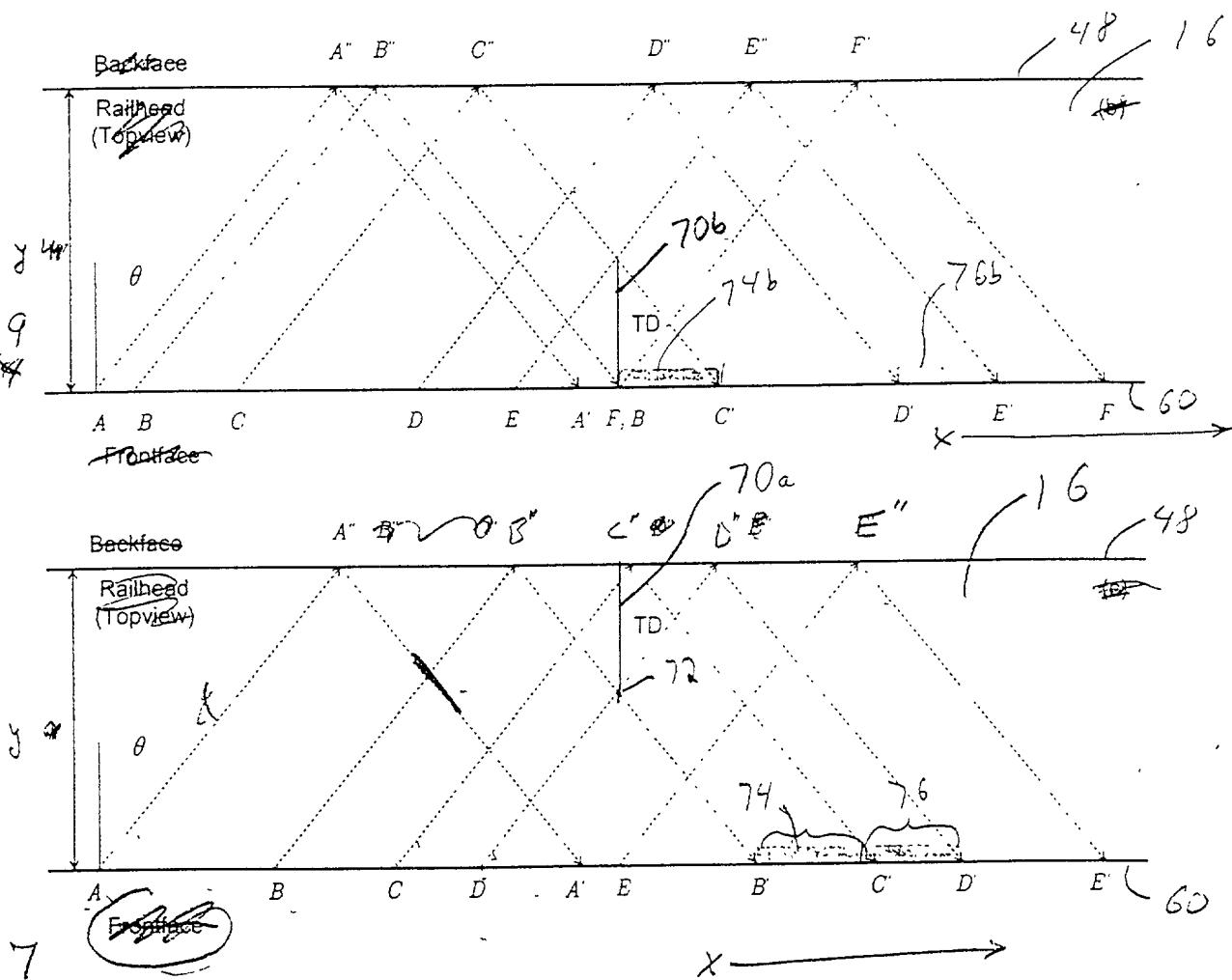
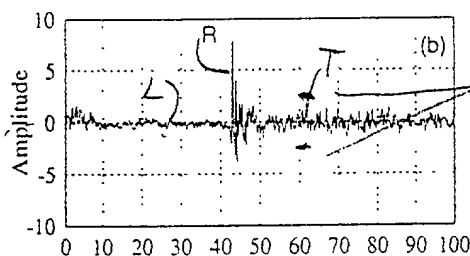


Figure 4: Three different rail railheads containing a transverse defect in each sample at different locations. The ultrasonic ray paths at various scanning positions are denoted by the dashed arrows.

F16.8A



F 16, 8B

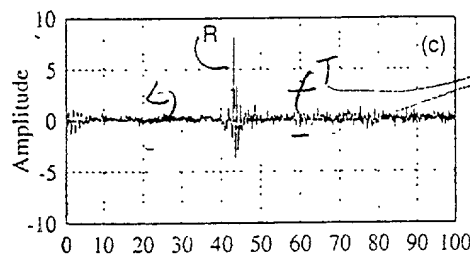


FIG. NO 8C

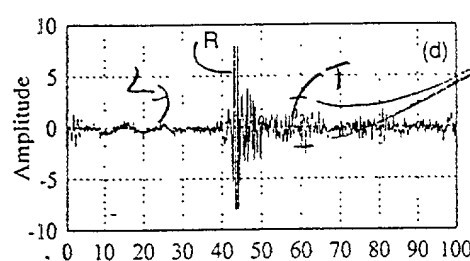


FIG. N8D

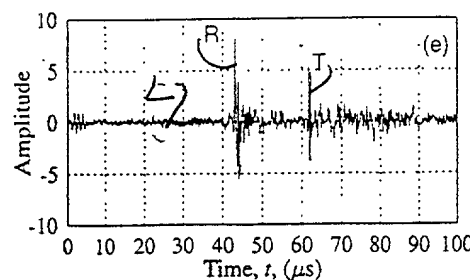
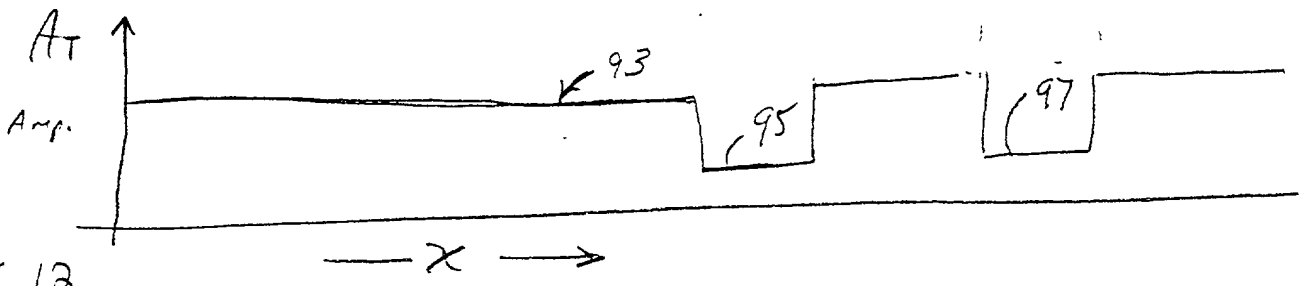
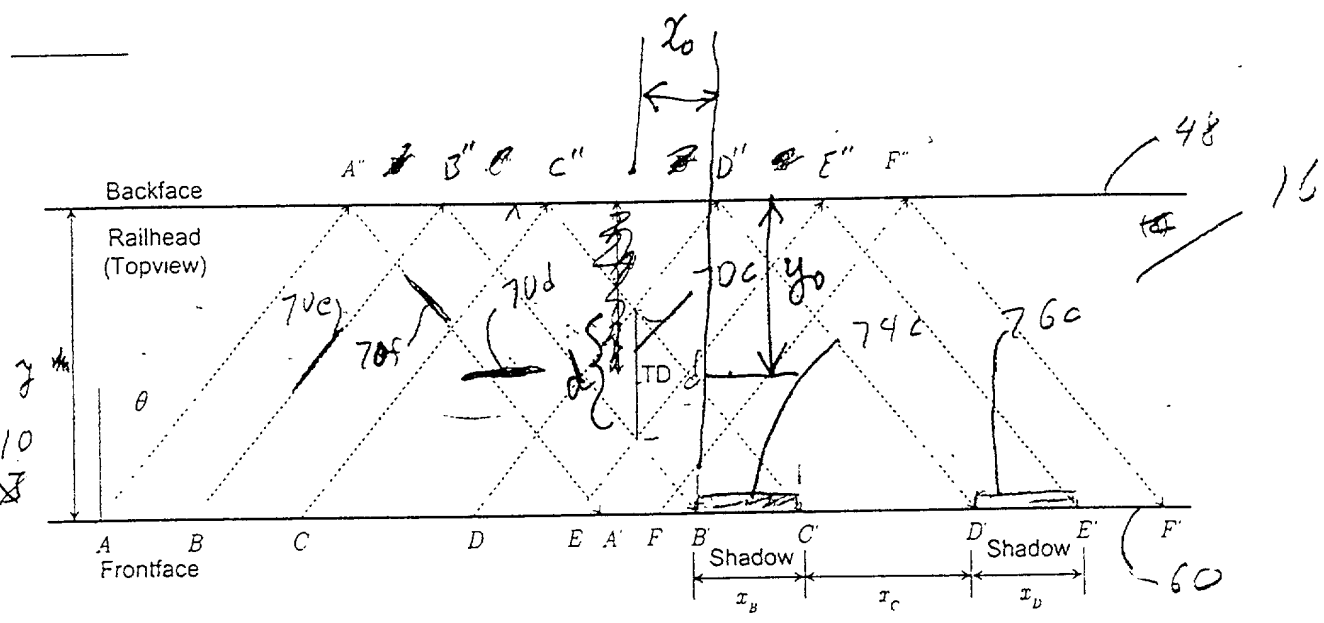
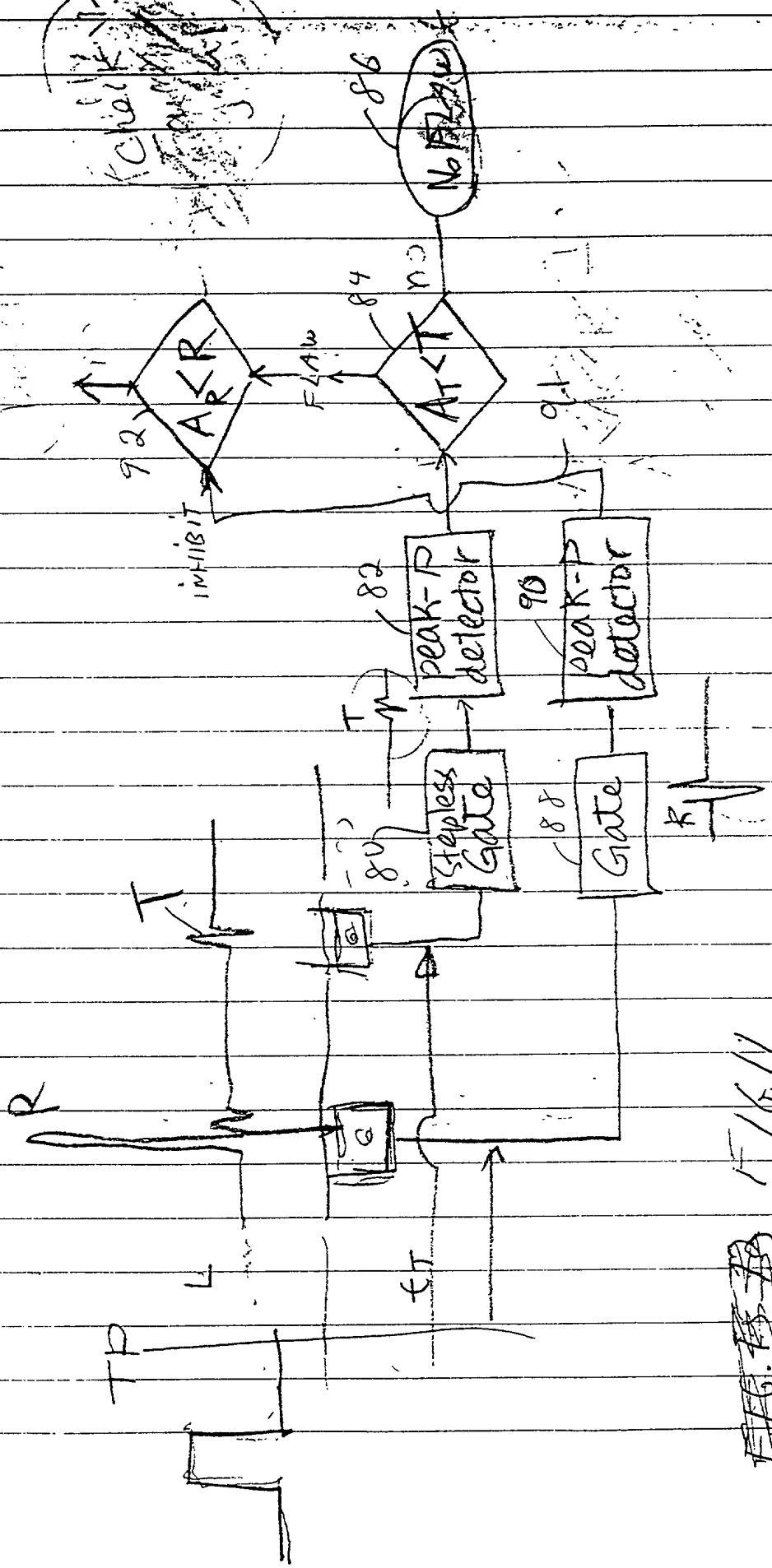


FIG. ~~28~~ 8E

FOSS010 STB8666

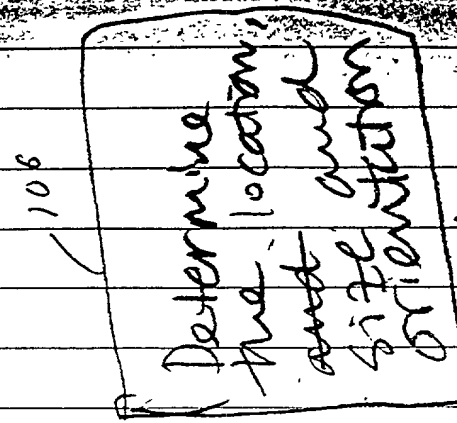
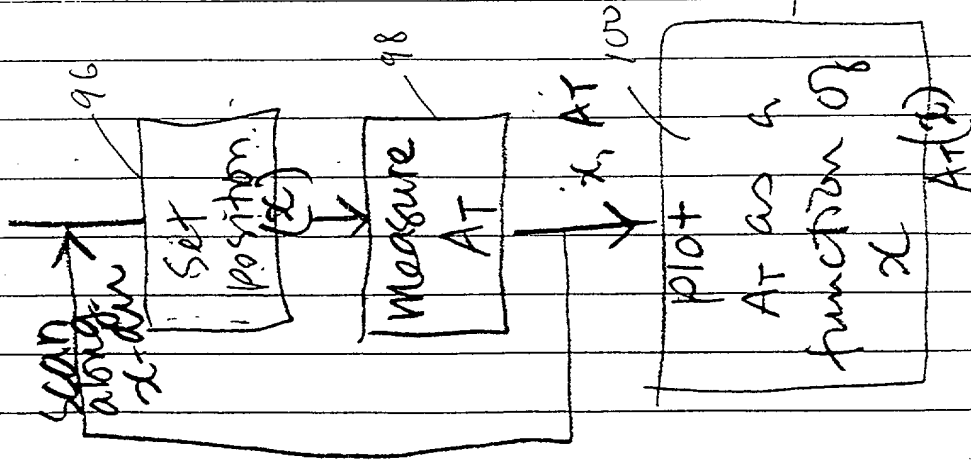


F=16.12

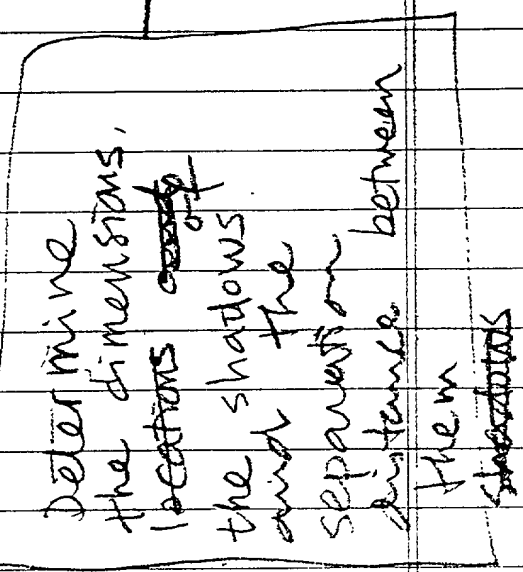


1/6/11

Diagram for flaw detection



104



102

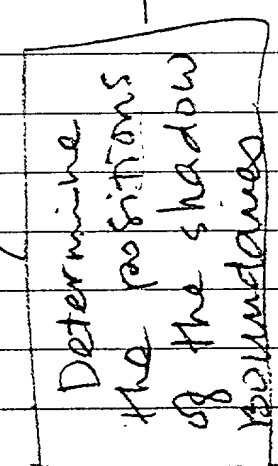
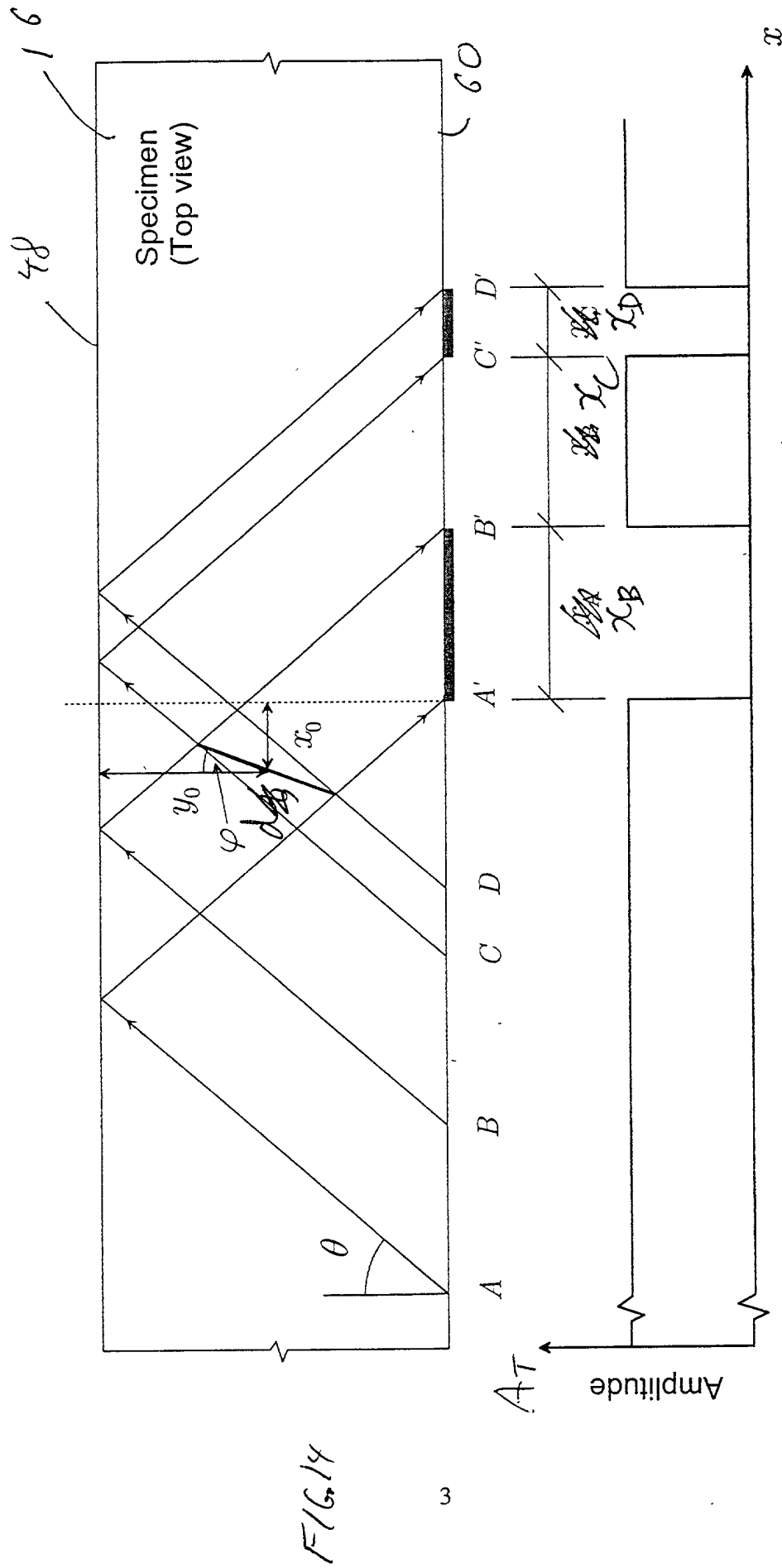


FIG. 13



51615

4121